Redescription of *Apochthonius moestus* (Banks), Type of the Genus *Apochthonius* Chamberlin (Pseudoscorpionida, Chthoniidae)

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Abstract: *Apochthonius moestus* (Banks) is redescribed from the holotype female and from numerous specimens taken in and near the type locality, Ithaca, New York. The species seems to be restricted to western New York and adjacent parts of northern Pennsylvania.

Chthonius moestus was described by Banks (1891) from specimens collected at Ithaca, New York, and preserved and studied in alcohol. It was designated as the type of the new genus *Apochthonius* by Chamberlin (1929a), who also published a brief supplementary diagnosis of the species based upon study of new material, mounted on slides, from Washington, D.C. and Missouri, as well as from New York. At that time Chamberlin noted that "this seems to be a somewhat variable species" (p. 67). Subsequent workers (Hoff, 1956, 1958; Lawson, 1968; Nelson, 1975) have placed most eastern and some western epigean specimens of *Apochthonius* in this single species, *A. moestus*. Consequently, the geographic range is said to extend throughout the eastern and central states, and as far west as New Mexico. Specimens from this extensive range, however, only roughly conform to a common pattern. For example, Hoff has described the teeth of the chelal fingers as "contiguous and uniform in size and shape" (1944, p. 125) and has illustrated the teeth in this form for specimens from Illinois (1949, Fig. 15) and from New Mexico (1956, Fig. 1). Lawson (1968), on the other hand, in his doctoral thesis on pseudoscorpions of the southeastern states, illustrates the chela with several of the teeth slightly longer than the majority. Although this discrepancy might seem insignificant, it becomes important when it is recognized that certain western species of the genus may be partially distinguished on the basis of tooth form. A second area of confusion is the lack of agreement in the literature concerning the limits of variation of palpal size and proportions. Lawson

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recently (1968) supported Hoff's observation (1945) that the length/width ratios of femur and chela reported by Chamberlin (1929a) differed from those of specimens from Illinois and North Carolina. While Lawson's specimens from the southeastern United States conform to the limits found by Hoff, they fall near the upper limit of the range. Although most measurements given for length of the male palpal femur are between 0.30 and 0.50 mm, Schuster (1966), without citing any locality data, characterized males of *A. moestus* as having the palpal femur in the range of 0.53–0.58 mm. This situation has developed because most of the morphological characters have never been adequately described. As subsequent authors have determined material obtained far from the type locality, increasing numbers of exceptions to presumed diagnostic characters of the species have been recognized in order to accommodate these additional "*moestus*-like" specimens.

Interest in understanding the real nature of *A. moestus* (Banks) was developed independently by the two authors of this paper. One of us (WBM) has become increasingly frustrated when trying to compare new cavernicolous forms of *Apochthonius* with the type species of the genus. And the other (EMB) recently found at Steens Mountain, Harney County, Oregon, a "*moestus*-like" female which she found impossible to place accurately in view of the confusing descriptions of *A. moestus* in the literature. To both of us, the obvious course of action was to redescribe the species in detail. Fortunately, EMB had discovered the holotype female of *Chthonius moestus* Banks in the J. C. Chamberlin Collection of Pseudoscorpions housed at Pacific University, Forest Grove, Oregon, and WBM had collected a number of specimens of *Apochthonius* from the vicinity of Ithaca, New York. Thus, a redescription of *Apochthonius moestus* is possible, based upon reexamination of the holotype as well as detailed study of specimens collected recently near the type locality.

Family Chthoniidae Hansen

Tribe Chthoniini Chamberlin

Genus *Apochthonius* Chamberlin

Apochthonius Chamberlin, 1929a, p. 66; 1929b, p. 152 (part); Beier, 1932, p. 41 (part); Hoff, 1949, p. 434; 1956, p. 2; Benedict and Malcolm, 1973, p. 621.

The diagnosis of the genus presented by Benedict and Malcolm is generally satisfactory, but one or two minor corrections and additions must be made.

Diagnosis (revised): With the characters of the family Chthoniidae. Palpal chela with setae *ib* and *isb* transversely paired on dorsum of hand proximad of middle; *isb*, *esb* and *eb* closely clustered on base of fixed finger; *it* and *est* closely paired and distad of middle of finger; *et* close to diploid setae at distal end; movable finger with *b* subbasal, *t* and *st* close together and just distad of middle, and *sb* more or less midway between *b* and *st*, sometimes closer to one than to the other. Marginal teeth of chelal fingers well-developed, contiguous; movable finger with a small, rounded sensillum on external surface near dental row, usually slightly proximal to level of *st*. Each coxa I with 3 (rarely 2) simple

setae ("coxal spines") on the face, each such seta originating from a socket in the posterior half of a low, elongate ridge, the anterior end of which is usually produced into a distinct point or spur. Intercoxal tubercle lacking. Chelicera large; hand with usual 4 setae (*is*, *sb*, *b* and *es*) plus a variable number of accessory setae; galea rudimentary, especially in male, though silk ducts present. Carapace distinctly narrowed posteriorly; anterior margin with small, dentate epistome; with 20–24 (rarely 25 or 26) setae, of which 6–10 are at anterior margin and 4 (rarely 3, 5, or 6) near posterior margin; epigean species with 2 pairs of eyes, usually corneate; cavernicolous species lacking eyes, or with 1 or 2 pairs.

Remarks: *Apochthonius* is most closely allied to *Kleptochthonius*; in fact, the two groups were for a long while considered to be subgenera of the original genus *Apochthonius* (Chamberlin, 1929b). The two have in common the following characters: 1) unique spinelike setae ("coxal spines") on coxa I; 2) no intercoxal tubercle; 3) distribution of trichobothria on chelal fingers; 4) small sensillum on movable chelal finger between trichobothria *st* and *sb*. Notable differences include: 1) marginal teeth of chelal fingers contiguous in *Apochthonius*, but widely spaced in *Kleptochthonius*; 2) carapace broad anteriorly and distinctly narrowed posteriorly in most *Apochthonius*, but usually nearly rectangular in *Kleptochthonius*; 3) species of *Apochthonius* usually smaller than those of *Kleptochthonius*.

Apochthonius moestus (Banks)

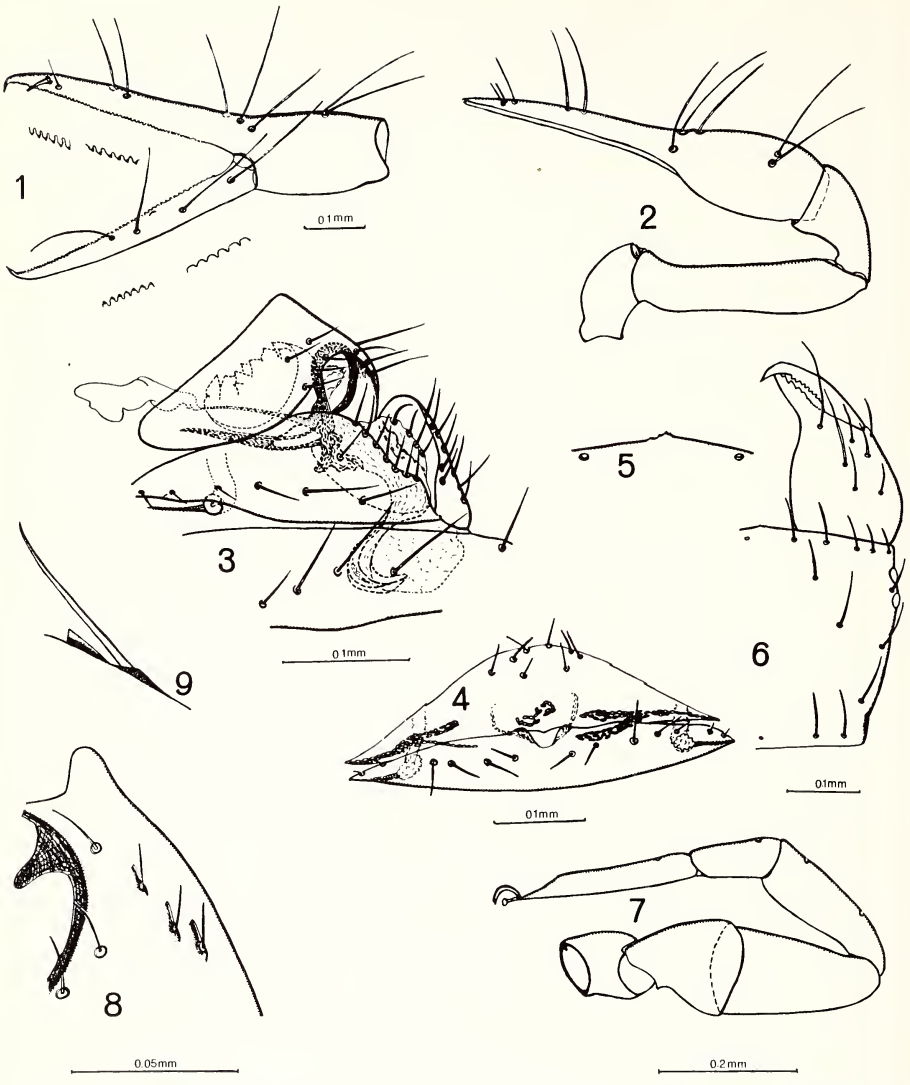
Figs. 1–9.

Chthonius moestus Banks, 1891, p. 165; 1895, p. 13.

Apochthonius moestus (Banks): Chamberlin 1929a, p. 67 (part): Beier, 1932, p. 41 (part): Hoff, 1958, p. 6 (part): Muchmore, 1963, p. 11; 1966, p. 278; 1967, pp. 89–92 (part): Benedict and Malcolm, 1973, pp. 695–696 (part). *Not* Chamberlin, 1929b, p. 153: *not* Hoff, 1944, p. 125; 1945, p. 311; 1946, p. 105; 1949, p. 434; 1951, p. 4; 1952, p. 42; 1956, p. 2; 1959, p. 4; *not* Hoff and Bolsterli, 1956, p. 158: *not* Schuster, 1966, p. 183.

Material upon which the redescription is based: Holotype female, collected by N. Banks sometime prior to 1891 from Ithaca, Tompkins County, New York, "under stones in spring" (Banks, 1891, p. 154); the specimen was mounted in Canada Balsam by J. C. Chamberlin and is deposited in the Museum of Comparative Zoology, Harvard University. One female (JC. 71.01001) from Enfield Glen, Tompkins County, New York, 20 October 1920, by C. R. Crosby. One male (JC. 70.01001) from "Deneyter County," New York, on 4 July 1922, by C. R. Crosby. [This locality listing is erroneous. The label reads, "Deneyter Lake, Madison County, New York," which also contains an error. The place is actually DeRuyter Lake, in the southwest corner of Madison County, about 40 miles NE of Ithaca.] Five males and 8 females (WM 851) on 28 November 1965, and 1 male and 2 females (WM 852) on 18 December 1965 from Taughannock Falls State Park, about 9 miles NW of Ithaca, Tompkins County, New York (W. B. Muchmore). Two males and 2 females (WM 1233) from Enfield Glen (R. H. Treman State Park), about 5 miles SE of Ithaca, New York, on 15 October 1967 (W. B. Muchmore). Nine males (WM 1633) from Ringwood Forest, about 7 miles E of Ithaca, New York, on 8 June 1968 (S. B. Peck).

Diagnosis (revised): With the characters of the genus as outlined above. Moderately small species (male 1.20–1.40 mm, female 1.25–1.45 mm body length); carapace normally with 24 vestitural setae of which 10 are at anterior margin and four near posterior margin; with 4 corneate eyes; movable chelal finger with occasional teeth slightly larger than the others.



FIGS. 1–9. *Apochthonius moestus* (Banks). 1. Lateral view of left chela; details of teeth 14–19 and 53–57 of fixed finger and of teeth 28–34 and 46–51 of movable finger. 2. Dorsal view of right palp. 3. Sublateral aspect of genital area of male (drawn by the late J. C. Chamberlin). 4. Genital area of female. 5. Epistomal area of carapace. 6. Carapace and right chelicera. 7. Leg IV. 8. Anterior half of right coxa I. 9. Lateral view of single "coxal spine."

Description of female (including holotype): With the general features of the genus. All parts pale tan. Carapace (Fig. 6) about as long as broad, markedly narrowed posteriorly; anterior margin with small, denticulate epistome in center and a few fine denticles laterally (Fig. 5); two pairs of moderate-sized, corneate eyes, posterior ones slightly smaller than anterior ones; anterior eyes about one ocular diameter from anterior margin of carapace, posterior eyes about one-half diameter from anterior ones; surface of carapace smooth dorsally, becoming distinctly reticulate laterally; chaetotaxy usually 10-4-4-2-4 = 24, but sometimes slightly different (rarely 9 or 11 at anterior margin, and 3, 5, or 6 at posterior margin); all setae of carapace shorter than width of palpal femur. Abdominal tergites and sternites entire; surfaces finely reticulate; pleural membranes covered with minute spinules; tergal chaetotaxy about 4:4:6:7:8:9:9:9:9:7:1T2T1:0; sternal chaetotaxy about 8:(4)6(4):(4)6(4):12:12:12:12:13:T2T2T2T:0:2; genital opercula as shown in Fig. 4. Coxal area unique; surfaces smooth; chaetotaxy usually 2-2-1:3-0-CS:2-2:2-3:2-3. Coxa I (Fig. 8) with pronounced, rounded apical process devoid of setae; with 3 characteristic setae ("coxal spines") on face, each seta long and acute, originating from socket in posterior half of a low, elongate ridge, the anterior end of which is produced into a distinct point or spur (Fig. 9). Intercoxal tubercle lacking.

Chelicera (Fig. 6) robust, about 0.85 as long as carapace; surface smooth except for patches of small, pointed, scalelike tubercles on hand dorsally and ventrally at bases of fingers; hand with 7 setae (*is*, *es*, *sb*, *b*, plus three accessory setae, in the notation of Chamberlin, 1931, pp. 64–65 and Fig. 13A); flagellum of 8 pinnate setae; movable finger with row of 9–12 teeth, becoming smaller basally and merging into a series of tiny granules; movable finger with an isolated tooth near tip and a row of 6–9 teeth diminishing in size basally; serrula exterior of about 17 blades, serrula interior of 11 or 12 blades; galea vestigial, barely elevated above finger margin around openings of silk ducts.

Palp moderately slender; femur about as long as carapace and chela about 1.5–1.6 times as long. Proportions of segments as shown in Fig. 2; trochanter 1.7–1.9, femur 4.1–4.55, tibia 1.65–1.9, and chela 4.3–4.8 times as long as broad; chelal hand 1.5–1.6 times as long as deep; movable finger 1.81–1.91 times as long as hand. Chelal dentition and chaetotaxy as shown in Fig. 1; in general, both fingers with contiguous marginal teeth, evenly graded in size and shape from base to tip, though an occasional tooth may be slightly longer or wider than adjacent ones; fixed finger with about 55–60 teeth, all with cusps except basal 3–5; movable finger with about 47–55 teeth, only the distal 18–25 being cusped, the more basal ones becoming rounded and low; small, elevated sensillum on outer surface of movable finger near dental margin, about midway between levels of trichobothria *st* and *sb*.

Legs relatively slender; legs IV of holotype lost, legs IV of others (Fig. 7) with entire femur 2.25–2.5, tibia 3.5–3.75, metatarsus 2.0–2.3, and telotarsus 5.5–6.0 times as long as deep. Long tactile setae on tibia about 0.45, on metatarsus about 0.25, and on telotarsus about 0.26 length of segment from proximal end.

Male: Essentially like female, but smaller and a little more slender. Genital opercula as shown in Fig. 3. Movable cheliceral finger usually without any evidence of an elevated galea, although silk ducts are present. Proportions of palpal segments: trochanter 1.65–1.95, femur 4.15–4.65, tibia 1.75–1.95, and chela 4.65–5.05 times as long as broad; chelal hand 1.6–1.75 times as long as deep; movable finger 1.89–2.00 as long as hand. Fixed chelal finger with 55–65 and movable finger with 50–60 marginal teeth; sensillum present on movable finger as in female.

Nymphs: Like the adults but paler, smaller, more robust, and with the reduced chaetotaxies characteristic of other chthoniids.

Measurements (mm): *Female* (First figures are for holotype, followed in parentheses by ranges for 14 other mounted females from Tompkins County, New York): Body length 1.42(1.25–1.45). Carapace length 0.415(0.42–0.48). Chelicera 0.385(0.36–0.41) by 0.19(0.185–0.215). Palpal trochanter 0.19(0.165–0.215) by 0.10(0.95–0.12); femur 0.415 (0.41–0.495) by 0.10(0.10–0.11); tibia 0.22(0.21–0.235) by 0.125(0.11–0.14); chela 0.67 (0.65–0.755) by 0.155(0.14–0.17); hand 0.245(0.225–0.27) by 0.155(0.14–0.18); movable finger 0.45(0.43–0.51) long. Leg IV: entire femur 0.385–0.45 by 0.16–0.185; tibia 0.265–0.30 by 0.075–0.08; metatarsus 0.13–0.15 by 0.06–0.065; telotarsus 0.245–0.27 by 0.045.

Male (Ranges for 9 mounted males from Tompkins County, New York): Body length 1.24–1.44. Carapace length 0.385–0.45. Chelicera 0.31–0.36 by 0.16–0.19. Palpal trochanter 0.16–0.19 by 0.095–0.11; femur 0.395–0.465 by 0.095–0.11; tibia 0.20–0.23 by 0.11–0.125; chela 0.64–0.72 by 0.13–0.155; hand 0.21–0.245 by 0.13–0.155; movable finger 0.41–0.48. Leg IV: entire femur 0.38–0.43 by 0.155–0.18; tibia 0.26–0.295 by 0.075–0.08; metatarsus 0.125–0.15 by 0.06–0.065; telotarsus 0.235–0.26 by 0.04–0.045.

Additional records of specimens apparently belonging to *A. moestus*: NEW YORK: Genesee County, Batavia and Bergen Swamp; Monroe County, Mendon Ponds Park and Powder Mills Park; Onondaga County, Tully Forest; Steuben County, Stony Brook Park; Tompkins County, along NY 89 5 miles N of Ithaca; Wayne County, Zurich Bog. PENNSYLVANIA: Tioga County, along Arnot Road S of Blossburg; Wayne County, 2 miles W of Hancock, NY; Berks County, Hawk Mountain; Schuykill County, Keefer Summit, near Reinerton; Clarion County, Cook Forest State Park; Carbon County, Palmerton and Little Gap; Northampton County, Fox Gap.

Specimens of *Apochthonius* not pertaining to *A. moestus* as defined have been found in numerous collections from central Pennsylvania (particularly the Susquehanna River Valley) southward and westward. Thus the distribution of this species appears to be limited to New York State and the northern and eastern parts of Pennsylvania.

Habitat: Banks found his specimens "under stones in spring" (1891, p. 165). The specimens taken by Muchmore and by Peck were obtained through Tullgren separation of damp litter from under and alongside logs or rotted stumps in mixed hardwood-conifer woodlands, mainly on hillsides along streams.

Remarks: As far as is known at present, *Apochthonius moestus* (Banks) is the only eastern member of the genus with 10 setae at the anterior margin of the carapace, and a total of 24 carapacial setae; all other forms have 8 or fewer setae at the anterior margin with a total of 22 or fewer. There are other differences as well, in the uniformity of chelal teeth, the position of the sensillum on the movable chelal finger, and size and proportions of various parts; but the details of these have yet to be worked out. *A. minimus* Schuster, and *A. malheuri* Benedict and Malcolm also have 10 setae on the anterior margin of the carapace with a total of 24. *A. moestus* can be distinguished from *A. minimus* by its larger size and the occurrence of only a small spur on the base of each coxal spine (see Benedict and Malcolm, 1973, pp. 625–626). *A. malheuri* is a large, troglobitic form with only two tiny eyes, impossible to confuse with *A. moestus*.

It is interesting to note that our specimens of *A. moestus* usually show some slight irregularity in the size of marginal teeth on the movable chelal fingers.

Occasional larger teeth were found by Hoff (1956) in *A. magnanimus* from New Mexico and were held to be an important difference between that species and *A. moestus*. Schuster (1966) has reported similar enlarged teeth on the chelal fingers of the 3 new species he described from the west coast. From our own observations it can be concluded that many specimens of *Apochthonius* from all over the United States have, on the movable finger, at least a few teeth which are larger than adjacent ones; therefore, it appears that this feature will have little taxonomic value until some patterns or degrees of difference have been detected.

The sensillum on the movable chelal finger appears to be a constant feature in all forms of *Apochthonius*. Its position seems to vary somewhat in different forms, but its usefulness as a taxonomic character is not yet clear. Similar sensilla have been observed in all other chthoniid pseudoscorpions we have examined (unpublished observations). The structure and position of these organs vary considerably among the genera and they may in future prove useful in establishing systematic relationships within the family.

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